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Microsoft Exchange Server 5.5 on the Compaq ProLiant 1600

Abstract: The Compaq ProLiant 1600 is well suited as a Microsoft Exchange Server deployment platform for small and medium-sized organizations, and for satellite locations of larger organizations. It is a high performance server with uptime features unmatched in its class. Using Microsoft's Load Simulation utility, the new ProLiant 1600 with two 400 MHz Intel Pentium® II processors was tested with user loads of 8000 simultaneous MAPI e-mail users at Compaq's Microsoft Competency Center located in Redmond, Washington.

Microsoft Exchange Server has been the focal point for extensive development and testing by both Microsoft and Compaq. Throughout this activity, Compaq and Microsoft have worked to optimize Microsoft Exchange Server performance on Compaq server products to provide an optimal balance between performance, availability, manageability, and cost

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Compaq ProLiant 1600

The Compaq ProLiant 1600 6/400 is a high performance server for workgroup and remote-office applications with uptime features unmatched in its class. A state-of-the-art 400 MHz Pentium II processor with dual processing capability provides exceptional performance, while the hot-plug drives and optional hot-plug redundant power supply deliver increased uptime. The ProLiant 1600 6/400 also provides plenty of headroom for growing network demands, with support for 45.5 GB of hot-plug storage, memory expandable to 1GB and 6 I/O expansion slots.

Key Features

- Intel Pentium® II processor 350 or 400 MHz (dual processor capability)
- 512-KB second level ECC cache standard
- 100 MHz GTL Bus Design
- 64-MB 100 MHz registered SDRAM memory standard, expandable to 1 GB
- Two PCI and four shared PCI/ISA slots (six total slots)
- Compaq Netelligent 10/100 TX PCI UTP Controller (embedded) on the PCI local bus
- Integrated Dual Channel Wide-Ultra SCSI-3 Controller
- Support for up to five 1-inch or two 1.6-inch and one 1-inch hot-plug hard drives
- Internal hot-plug storage capacity up to 45.5 GB. Maximum storage up to 63.7 GB (includes two available removable media bays)
- I2O Ready
- Integrated Management Display (IMD) (optional)
- Compaq Hot-Pluggable Redundant Power Supply (optional)
- Easy-to-service chassis
- Preinstalled CD-ROM Drive IDE
- Compaq Insight Manager, SmartStart, Integrated Remote Console (IRC) and Automatic Server Recovery-2 (ASR-2)
- Protected by Compaq Services, including a three-year on-site limited warranty and extended Pre-Failure Warranty which covers Intel Pentium II processors, memory and disk drives.

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Performance Results

The benchmark was conducted using Microsoft's Load Simulator tool. For each test, the Load Simulator Medium MAPI canonical profile was chosen. The Medium MAPI profile reflects the task workload of a typical corporate e-mail user, including common daily mail tasks such as send, browse, read, and forward, as well as calendaring tasks and distribution list usage. The Response Time score represents a 95th-percentile score of the measured test run. The score is expressed in milliseconds (ms). The ProLiant 1600 Response Time score of 230 ms is well below the 1000 ms acceptable threshold for e-mail users utilizing Exchange Server's MAPI protocol. Microsoft has certified these benchmark results based on the Microsoft Exchange Server 5.5 UPS (Users Per Server) Policy Guidelines V1.0.

Table 1. Performance Highlights (ProLiant 1600, 6/400, 2 CPU, 1024 MB RAM)

User Load	8,000
Response Time (milliseconds)	230
Messages Submitted (8-hour period)	115,712
Messages Delivered (8-hour period)	147,090
Messages Recipients Delivered (8-hour period)	644,042
Messages Sent (8-hour period)	31,374

Note: Test results based on Microsoft Exchange Server 5.5 UPS Policy Guidelines V1.0. The test result disclosure can be found in Appendix A

Table 2. Compaq ProLiant 1600 Tested configuration

(2) Intel Pentium II 400-MHz – 512K Level-2 writeback cache per processor
1024 MB ECC SDRAM DIMMs
(2) SMART-2/DH Array Controller
OS/Pagefile/Exchange DS/MTA Files: (2) 4.3-GB Drives – RAID1
Exchange Log Files: (2) 4.3-GB Drives – RAID1
Exchange Information Store Files: (12) 4.3-GB Drives – RAID0
Compaq Netelligent 10/100 TX Embedded UTP NIC
Microsoft Windows Enterprise Server NT 4.0 with Service Pack 3
Exchange Server v5.5 –Enterprise Edition (Tuning: Perfwiz defaults)

Note: The test results disclosure can be found in Appendix A.

What the Benchmarks Don't Tell You

It is important to understand that benchmarks such as these are designed to give Exchange Server implementation planners baseline references for understanding the capabilities of hardware platforms from a single vendor such as Compaq or other competing hardware vendors. When interpreting these benchmarks, however, two things should be kept in mind.

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First, consider whether benchmarks are performed on what can be referred to as customer-deployable configurations. A hardware vendor may publish a result that is based on a platform or configuration that should not be deployed in a real-world Exchange Server deployment. For example, many vendors have published results using disk subsystems configured with RAID0 disk arrays. While RAID0 does provide the highest levels of disk subsystem performance, it fails to provide any protection against data loss. In addition, most vendors, including Compaq, conduct benchmarks for Microsoft Exchange Server that are single-server in nature. In the real-world of messaging, customer sites are usually multi-server and multi-site. Single-server, single-site lab benchmarks do not account for the communication demands from other servers on the network.

Second, keep in mind that benchmarks do not account for issues such as backup and disaster recovery or information store maintenance sizing. Whatever the issue, care must be taken when interpreting benchmarks to ensure that they represent useful information for your Exchange Server deployment and are based on valid simulation methodologies.

While it is significant that the ProLiant 1600 server can successfully scale to 8000 medium MAPI e-mail users in a single site, single store benchmark exercise, Compaq does not recommend deploying 8000 users on this configuration. Compaq recommends careful evaluation of all issues involved in real-world Exchange Server deployments such as management, administration, and disaster recovery.

Load Simulator

The main tool used in generating the workload for this scalability demonstration was the Microsoft Exchange Server Load Simulation utility called Load Simulator. Load Simulator is a tool for simulating a client user load on an Exchange Server. Its purpose is to enable a single Windows NT machine called a LoadSim client to simulate multiple Microsoft Exchange client users.

The operation of Load Simulator users is governed by a Load Simulator profile. This profile controls factors such as how long a Load Simulator "day" is, how many e-mail messages to send in a day's time, how many times to open and read e-mail, whether to use distribution lists, whether to use public folders, etc.

Load Simulator creates a highly accurate simulation of reality. It mimics the full Microsoft Exchange Client in many respects. First, it uses .MSG files, the same format used by the Exchange Client. This guarantees that messages generated by Load Simulator have the same properties as those sent by real users of the Exchange Client. Second, Load Simulator uses the same MAPI remote procedure call (RPC) semantics as those used by the Client. Third, Load Simulator registers MAPI change notifications in the same manner as they are registered by the Client. Finally, Load Simulator even emulates the Microsoft Exchange Client list box cache, which the Client uses for folder and message panes in the viewer when a user browses and selects messages on the server.

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Several steps are necessary to perform a successful simulation. The Load Simulator setup and initialization process comes first. Load Simulator creates the test topology by generating the user directory entries. Next, the test store is initialized and populated with the test messages and folder items. The tests are typically run for up to 8 hours depending upon the user load simulated and amount of time required to reach a steady state for measurement purposes. During a test run, users log on to the Exchange Server and begin processing various messaging tasks. Task response time data is logged to the LSPERF.LOG file and client messages and error logging are stored in the LOADSIM.OUT file. To produce test scores, the LSLOG utility is used to parse the LSPERF.LOG file and calculate the response time score. By default, 95th- and 50th-percentile response time scores are calculated. Ninety-fifth-percentile response time scores for the MAPI/RPC protocol should be less than 1000 ms, according to Microsoft. Also, the Exchange Server IS Send Queue and the MTA Work Queue (other message and delivery queues should also be considered, depending on the protocol) must consistently return to near zero during the steady-state period for which test measurements are taken. Queues that continue to grow and fail to return to near zero indicate that the server is not sustaining the required workload. There should be no errors logged by the LoadSim clients during the test. When these conditions are met, a successful test run has been completed. For more information on LoadSim Medium canonical profiles, please refer to the LoadSim documentation at: http://www.microsoft.com/exchange/library/loadsim55x86.exe.

Balancing Scalability and Availability

While server performance and capacity are key criteria in selecting a messaging deployment platform, one must also consider price and performance. Several competing hardware vendors offer platforms capable of supporting heavy user loads. They also provide these systems at a price significantly higher than Compaq's price. Compaq delivers leading performance on industry-standard platforms with the lowest total cost of ownership.

For many corporations, messaging and collaboration have recently become mission critical. Unscheduled downtime for any server can result in a significant loss of productivity. To limit exposure to downtime, Exchange Server 5.5 and Compaq ProLiant Clusters provide high availability through Microsoft Cluster Server (MSCS). When MSCS is deployed on Compaq ProLiant Clusters, enterprise-messaging customers can achieve scalability without sacrificing the reliability that is required in an enterprise environment.

Another critical concern is backup and disaster recovery. Compaq provides industry-leading tape array and library hardware solutions integrated with applications such as Computer Associates' Cheyenne ArcServe. These solutions will help meet the requirements of enterprise customers deploying messaging and collaboration applications.

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APPENDIX A: TEST DISCLOSURE

Table 3. LoadSim Clients and Configuration

LoadSim Clients	Configuration
Network type (10Base T, Token Ring, etc.)	100 Base-TX
Number and type of clients	(≤40) 2x5/133, 128 MB RAM (≤ 250 users each) or better (indicates minimum configuration)
Number and type of hubs/concentrators (full duplex, switching, etc.)	Compaq Netelligent 5708 Switch and Netelligent 2624 Hub
Number of clients/segment	20
Client CPU type and speed in percentages	2P/133-MHz Pentium processors or better
Client network controller broken down by percentages	Compaq Netelligent 10/100
Client network software name and version (drivers, protocols, redirector)	Microsoft Windows NT Workstation 4.0 with SP3 TCP/IP
Size of any client network cache	None
Network controller software	Compaq Netelligent 10/100 driver
LoadSim version	5.5 (Build 2187)

Note: Response time measurements were taken from a LoadSim Control Client simulating 100 users configured with 96 MB RAM and a Pentium/166 CPU. The client is located on an isolated network segment connected to a 100-Mb/s switch.

Performance Data Disclosure

8,000 Users (Measured during test run at steady state)

Table 4. Summary

Supported Benchmark Load	8,000 Users
Weighted 95th Percentile Score	230 milliseconds
Benchmark Profile	LoadSim Medium User
Protocol	Exchange MAPI
Length of Steady State	4 hours
Length of Test	8 hours

Table 5. Transaction Load (hourly)

Messages Submitted	14,464.0
Messages Recipients Delivered	80,505.25
Messages Sent	3,921.75

Table 6. Transaction Load (per second)

Messages Opens/Sec	30.133
Folders Opens/Sec	7.482
RPC Read Bytes/Sec	25,592
RPC Write Bytes/Sec	179,444

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Table 7. Transaction Queues

IS Send Queue Average Length	3.737
MTA Work Queue Average Length	0.737

Table 8. Processor Utilization

System Processor Utilization (%)	72.84
System Processor Queue Length	2.899
System Context Switches/Sec	2,388
Process % CPU Time - Store	115.20
Process % CPU Time - DS	9.82
Process % CPU Time - MTA	7.38

Table 9. Memory Utilization

Available Bytes	4.89 MB
Pages/Sec	0.038
Process Working Set Bytes - Store	965 MB
Process Virtual Bytes - Store	1.40 GB

Table 10. Logical Drive Utilization

IS Database Disk Reads/Sec	205.469
IS Database Disk Writes/Sec	122.614
IS Database Average Disk Queue Length	4.847
IS Log Disk Reads/Sec	0
IS Log Disk Writes/Sec	91.572
IS Log Average Disk Queue Length	0.039

Descriptive Terms

Messages Submitted

Submit calls made by clients. This equates to total message sends by users.

Messages Sent

Messages that the Store sends to the MTA (not messages sent by clients). Normally all messages submitted by the clients are sent to the MTA, except in the case where all recipients are local mailboxes. In that case, since all the deliveries can be performed locally, no message is sent to the MTA.

Message Recipients Delivered

Separate mailboxes that messages have been delivered to. Think of this as the number of Reads that are 'caused' by sending a message (one per recipient).

Message Opens/Sec

Messages accessed for reading per second

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Folder Opens/Sec

Folders opened for browsing per second

RPC Read Bytes/Sec

RPC Bytes read from clients (i.e., submit calls)

RPC Write Bytes/Sec

RPC Bytes written to clients (i.e., message opens)

IS Send Queue Average Length

Send Queue Size is the number of messages in the private information store's send queue.

MTA Work Queue Average Length

Work Queue Length is the number of outstanding messages in the Work Queue, which indicates the number of messages not yet processed to completion by the MTA.

Note: Performance results were measured using Microsoft NT Performance Monitor. Measurements were obtained by measuring averages for the period of steady-state activity (i.e., after 8,000 users were successfully logged on). Tests measure the messaging throughput of a single-server, single-site topology. For deployment-specific information, contact a Microsoft or Compaq representative. More information can be found at:
http://www.microsoft.com/exchange/support/deployment/planning/deploy.asp?A=5&B=1

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APPENDIX B: RELATED DOCUMENTS

These documents are available on the Compaq website.

Compaq and Microsoft Demonstrate Enterprise Scalability with Exchange Server 5.5

http://www.compaq.com/support/techpubs/whitepapers/ECG0961197.html

Microsoft Exchange Server 5.5 on the Compaq ProLiant 850R

http://www.compaq.com/support/techpubs/whitepapers/ECG0710698.html

Microsoft Exchange Server 5.5 on the Compaq ProLiant 3000

http://www.compaq.com/support/techpubs/whitepapers/ECG0720698.html

Microsoft Exchange Server 5.5 on the Compaq ProLiant 6000 Class Servers

http://www.compaq.com/support/techpubs/whitepapers/ECG0730698.html

Compaq Deployment and Configuration Guide: Microsoft Exchange Server on Compaq ProLiant Servers

http://vcmproapp02.compaq.com/

Performance of Exchange Server 4.0 on Compaq ProLiant Servers

http://www.compaq.com/support/techpubs/whitepapers/444A0696.html

Deschutes Family Processor Technology

http://www.compaq.com/support/techpubs/whitepapers/ecg0500698.html

Disk Subsystem Performance and Scalability

http://www.compaq.com/support/techpubs/whitepapers/ECG0250997.html

Configuring Compaq RAID Technology for Database Servers

http://www.compaq.com/support/techpubs/technotes/184206-1html

Compaq SMART-2SL Array Controller Technology

http://www.compaq.com/support/techpubs/whitepapers/667A0697.html

Hardware vs. Software Fault Tolerance

http://www.compaq.com/support/techpubs/whitepapers/ECG0660298.html

Compaq Pentium Pro Processor-based Servers

http://www.compaq.com/support/techpubs/whitepapers/308A0496.html

Configuring the Compaq ProLiant 5000 Server for Peak Performance

http://www.compaq.com/support/techpubs/whitepapers/679A0697.html

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